CHAPTER I

INTRODUCTION

1.1 Introduction

Antenna designers are always searching for ways to improve existing designs or introduce novel designs in order to achieve desirable radiation characteristics, reduce the size and weight, which are mandatory requirement for antennas used in WLAN and thus make antennas more cost efficient [1].

Return loss, axial ratio, gain, bandwidth and received signal strength are some of the important properties which are improved.

The recent explosion in information technology and wireless communications has created many opportunities for enhancing the performance of existing signal transmission. An indispensable element of any wireless communication system is the antenna. Transmission of data at higher rates requires adequate bandwidth for the elements constituting a communication link accordant to IEEE802.11b/g standard which well-handled in this project [2].

For WLAN applications, where problems such as multi-path fading due to reflections from various scatters occur, a linearly polarized RWSA antenna is a preferable option. The reason is that this polarization enhances overall system diversity and permits freedom of orientation for the user-end antenna [3].

Radial waveguide slot array Antennas (RWSA) is very attractive for applications in communication devices for wireless local area network (WLAN) systems in the 2.4 GHz (2400–2484MHz), the free Industry-Scientific-Medicine (ISM) frequency band [4]. Work investigated on development of the low profile unidirectional Radial Waveguide Slot Array Antenna as a potential alternative to the WLAN AP antenna.

1.2 Problem Statement

The problem statement of this project is stated in the follow: WLAN users often complain of poor signal coverage. Therefore, an antenna with High gain and directivity suitable for indoor and outdoor WLAN in 2.4GHz ISM band is required, other point is the importance of obtaining a satisfactory coverage can not be over emphasized.

Theoretical results are obtained to satisfy good return loss requirements and specific radiation pattern shapes for the RWSA antenna, but the practical result is still big challenge to be verificated and prove that down-to-earth.

1.3 Objective

The proposed project proposes a development of the low power profile for a unidirectional antenna depending on Radial Waveguide Slot Array Antenna (RWSA), which is attractive for point-to-multipoint point communications, linear polarized small RWSA antenna as an external antenna for access point of WLAN based on IEEE 802.11b/g standard, and the simulation design will done according to the Federal Communication Commission (FCC) regulations, by depending on the simulation results prototype will be doe and tested in Lab, and test bed as a field trial.

1.4 Research Scope

The Research introduces:

1. WLAN protocols such as IEEE 802.11a/b/g free ISM band for which RWSA antennas are aimed to be designed.
2. The antenna specifications include parameters such as frequency, bandwidth, polarization, gain and all theoretical investigations.
3. Following that the simulation tools for antenna design based on Zeland Fidelity, FDTD, with Full-3D EM Simulation for the radiation pattern will be introduced.
4. Using of the linear polarization to improve the antenna gain.
5. Simulation of the Radiation pattern until reach the best result, and compare with previous design in field pattern and return loss result.
6. simulation result should be proven for indoor WLAN then outdoor WLAN
7. The prototype will be produced based on the simulation to involve the design and development of the low profile antenna; it will be tested in Lab and test bed as a field trial to measure the antenna performance.
8. Comparison of measured prototype with simulation.
9. Report / Thesis writing.

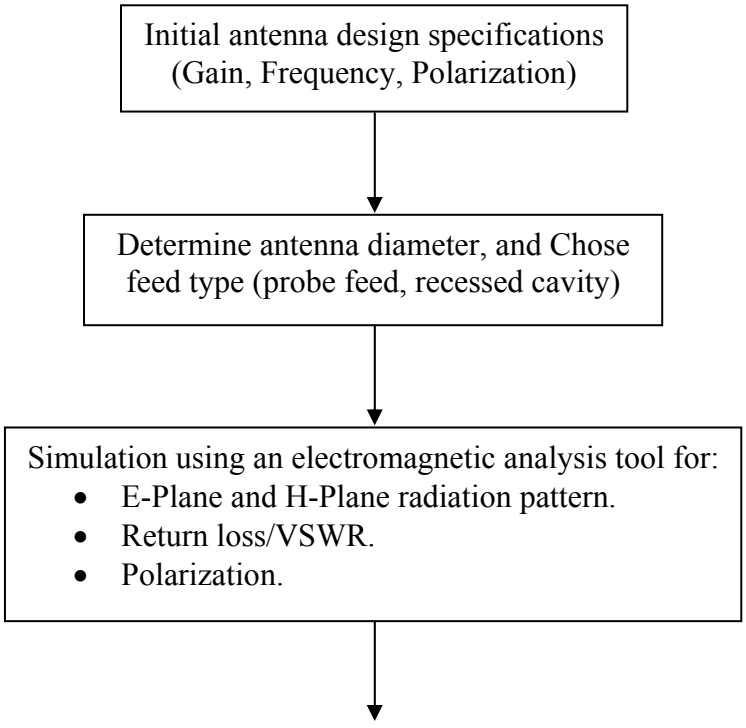
1.5 Research Methodology

A reactive theoretical and experimental design approach was utilized to optimize the antenna structure, the strategy implemented for simplifying the design and development procedures in this research work can be divided into the following points:

1. initial concept
    - literature review
    - problem statement
    - design conceptual understanding

2. Design and simulation stage
    - Slot pattern design and desired radiation pattern and polarization.
    - Antenna input impedance.
    - Compare between this design and previous design.
3. Prototype stage
    - Antenna fabrication.
4. Measurement stage.
    - Radiation pattern.
    - Return loss.
5. Analysis stage.
    - Comparison between the measurements and the simulation results.

The antenna fabrication needs to fit within the costing constraints and the availability of materials. The design and development procedures are briefly summarized in the following chart Figure 1.1 in particular, this methodology provides an approximate chronological progress of the work performed to finally complete the full design cycle.



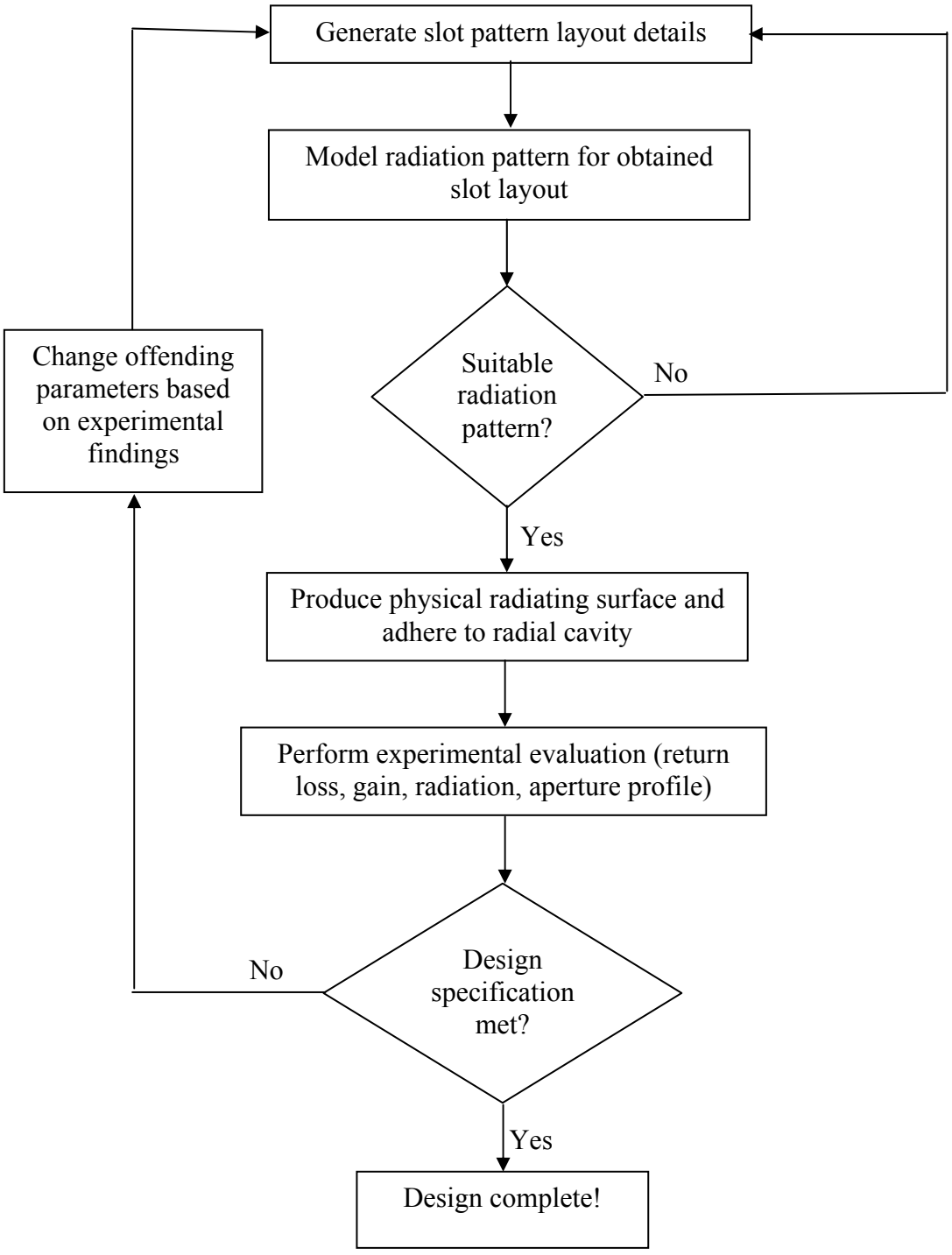


Figure 1.1: Flow chart representing a unified design of RWSA antenna.

1.6 Thesis Outline

Chapter 1: Consists of introduction of the project. Brief General Background is presented. The objectives of the project are clearly phased with detailed. The research scope and methodology background are also presented.

Chapter 2: Includes section1 of the literature review, introduction to the wireless communication, begins with an overview of indoor and outdoor contents then IEEE standard. Radial Waveguide slot array antenna evaluation and general description to the profile structure characteristics and its type also presented with theory background, historical development.

Chapter 3: Design and simulation modeling for the antenna, provides descriptions of the initial calculation results of the model and techniques for the finite difference time domain, design and simulation results, compare the result with the previous design.

Chapter 4: Presents the results of antenna prototype measurements and apply the antenna in the real environment, starting with the indoor application then applied the RWSA antenna outdoor.

Chapter 5: Concludes the thesis. The conclusion is given based on the analysis of results from the previous chapter and suggestion for future research.